

## GARRETT BERNSTEIN

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(781) 454-7070

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**Research Interests:** Machine Learning; Graphical Models; Aggregate Data

**Research Applications:** Computational Sustainability; Differential Privacy

### EDUCATION

**University of Massachusetts Amherst**, Amherst, MA

(Expected) May 2019

*PhD:* Computer Science

*Advisor:* Daniel Sheldon

**Cornell University**, Ithaca, NY

May 2011

*Master of Engineering:* Computer Science; *GPA:* 3.75/4.0

*Masters Project:* Systems Lead on video game to teach computer science and environmentalism to middle school students as part of NSF Computer Science Exploration Grant for Computational Sustainability

**Cornell University**, Ithaca, NY

May 2010

*Bachelor of Science:* Applied & Engineering Physics; *GPA:* 3.28/4.0

*Minors:* Computer Science, Information Science

### EXPERIENCE

**University of Massachusetts Amherst**

September 2014 - Present

Machine Learning for Data Science Laboratory

*PhD Research Assistant*

- *Noisy, aggregate data:* Developed the first provably consistent estimator of a time-homogeneous Markov chain given only noisy, aggregate data by employing a method of moments framework. This problem has applications such as tracking bird migration from citizen science count data, maintaining privacy by learning models of human mobility from aggregate data, and modeling credit risk trajectories of financial institutions. Proved that conditional least squares, a longstanding method for estimating from aggregate data, is inconsistent given noisy observations.
- *Bird migration analysis:* Working with ornithologists and fellow computer scientists to better understand continent-wide bird migration, including: Contributing to a system for automatic extraction of migration information from weather radar. Aiding an international and multi-disciplinary group in visualizing migration patterns to provide more effective public outreach for environmental issues. Working on a small research team to develop migration-intensity forecasting methods and evaluate their effectiveness for use cases in mitigation of migration hazards.

**McKesson Corporation**

June - August 2016

Relay Health Client Services Team

*Data Science Intern*

- *Predicting hospital readmission:* Developed generalized additive model (GAM) to predict risk of readmission for hospital patients. The resulting predictive work list allowed transition nurses to prioritize patient needs more effectively. GAM outperformed expert knowledge checklist by 0.10 AUC in assessing historical data.

**MIT Lincoln Laboratory**

September 2011 - May 2014

Intelligence and Decision Technologies, Lexington, MA

*Associate Technical Staff*

- *High fidelity network simulation:* Developed a mixed-membership, agent-based, simulation model to generate easily parameterizable, high-fidelity network data. Successfully applied the model to the domain of intra-city transportation for testing network detection algorithms. Presented paper at the Annual Simulation Symposium as part of the Spring Simulation 2013 Multi-Conference and received Best Paper Award.

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- *Network detection performance*: Collaborated with colleagues in academia to create a principle framework for network detection. Provided integral support by understanding each algorithm and network model we study in order to design empirical experiments. Determined algorithmic performance across a large parameter space. Our manuscript describing the detection theory and my empirical results is pending publication to the IEEE Transactions on Signal Processing.
- *Operational text classifier*: Implemented a multi-label support vector machine classifier for unstructured, human-generated text. Created descriptive and useful labels of the complicated scope of data in collaboration with U.S. military intelligence analysts. Experimented with various features and tuned classifier to achieve accuracy and false alarm rate acceptable for operational use. Successfully incorporated classifier into larger system to greatly decrease amount of required manual labeling.
- *Dynamic intelligence product*: Designed a Google Earth layered display of geographical intelligence for U.S. military intelligence analysts. Created a system to automatically generate a KML file of the display to provide analysts with a flexible human-machine interface. Generated products were incorporated by analysts into presentations and reports that informed decisions at the four-star General level.

### MIT Lincoln Laboratory

*Surveillance Systems; Space Control Systems*, Lexington, MA

Summer 2009, 2010

*Summer Intern*

- Designed, implemented, and tested a Java software infrastructure to analyze and compare the robustness of satellite correlation algorithms.
- Successfully detected differences and similarities in correlation accuracy in multiple test scenarios, as well as identified multiple flaws in the algorithms.
- Developed a method to quantify performance of the Antenna Algorithm employed in the Staffed NextGen Tower Initiative. Derived aircraft positions from multiple types of radar and calculated actual antenna offset lengths. Obtained a correlation value of 0.92 between actual and expected aircraft position via heuristic table-lookup approach.
- Designed and implemented Matlab GUIs to increase the efficiency of airport radar data analysis. The GUIs aided in efficiently setting up and running batches of scripts.

### PUBLICATIONS

- Shamoun-Baranes, J., Farnsworth, A., **Bernstein, G.**, et al. “Innovative Visualizations Shed Light on Avian Nocturnal Migration” PLOS ONE, 2016
- **Bernstein, G.**, and Sheldon, D. “Consistently Estimating Markov Chains with Noisy Aggregate Data.” Proceedings of the 19th International Conference on Artificial Intelligence and Statistics (AISTATS) 2016
- Winner, K., **Bernstein, G.**, and Sheldon, D. “Inference in a partially observed queueing model with applications in ecology.” *In Proceedings of the 32nd International Conference on Machine Learning (ICML) 2015*
- Smith, S., Senne, K., Kao, E., **Bernstein, G.**, Philips, S. “Bayesian Discovery of Threat Networks.” *IEEE Transactions on Signal Processing, Vol. 62, No. 20., October 2014*
- Smith, S., Kao, E., Senne, K., **Bernstein, G.** “Bayesian Network Detection Using Absorbing Markov Chains.” *ICASSP 2014*.
- **Bernstein, G.** and O’Brien, K. “Stochastic Agent-Based Simulations of Social Networks.” *Proceedings of 46th Annual Simulation Symp. 2013*.
- Smith, S., Senne, K., Philips, S., Kao, E., **Bernstein, G.** “Covert Network Detection.” *Lincoln Laboratory Journal. Vol. 20. 2013*